Partnerships that Work – A Review of US Government/Industry Cooperative Research Agreements

Dr. Gary W. Allen
AMC Liaison Officer to the German Federal Office of
Defense for Technology and Procurement (BWB)
Postfach 300165
56057 Koblenz
GERMANY

Email: gary.allen@us.army.mil

1.0 INTRODUCTION

1.1 Rationale

The purpose of this paper is to familiarize the reader with the methods that industry and US Government agencies use to share research and technology. During the course of the discussion, the reader will become familiar with the basis in law that supports these regulations, the primary vehicles used to formalize cooperation, and see examples of relevant programs. This presentation also lists various Internet sites that contain additional information.

1.2 Legal Background

The Stevenson-Wydler Act (15 USC 3701 et seq.) made technology transfer a part of the mission of every federal laboratory. Its intent was to maximize the benefit of taxpayer investment in federal R&D. The Federal Technology Transfer Act of 1986 (PL 99-502), which amended the original law, provided significant new authorities for Army laboratories to establish Cooperative Research And Development Agreements (CRADA) with private companies, as well as with public and non-profit organizations. Further, PL 99-502 authorized and Executive Order 12591 required that the commander or director of each appropriate Army R&D activity be delegated the authority to enter into CRADAs and to license, assign, or waive rights to intellectual property on behalf of the government. The National Technology Transfer and Advancement Act of 1995 (PL 104-113) amended these previous laws to provide additional incentives that encourage technology commercialization for both industry partners and federal inventors. It sought to promote industry's prompt deployment of inventions developed under a CRADA by guaranteeing the industry partner sufficient intellectual property rights to the invention, and providing increased incentives and rewards to laboratory personnel who create the inventions.

1.3 Overview

A long history of technology transfer exists between Army labs and R&D centers and the commercial and non-federal sector. Army technology can help to produce a stronger civilian economy, but only in partnership with academia and U.S. industry, who can advance new technology and bring new products, processes and services to the marketplace. Army technology transfer programs are a partnership with industry and academia to foster rapid, diverse, and profitable spin-offs of Army technologies to the non-federal sector and to promote dual-use technologies that simultaneously support both military and economic needs.

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2.0 COOPERATION AGREEMENTS

2.1 What is a MTA?

A Material Transfer Agreement (MTA) is a negotiated contract between the owner of a tangible material and a party seeking the material and the right to use the material for research purposes. The material may be either patented or not. Material transfer agreements tend to be shorter than license agreements, and they are generally considered more informal than license agreements, although both are enforceable contracts. The purpose of an MTA is to document the transfer and outline the terms of use, including identification of the research project, terms of confidentiality, publication, and liability. As with licenses, there are no standard MTAs. MTAs do not usually require financial payments at the time of the transfer, but many MTAs allow the provider to either own, or license exclusively, or obtain payments upon the sale of developments that the recipient makes with the provider's materials. These are loosely called "reach-through" provisions, and are considered by many providers to be desirable because they allow the provider to obtain rights in subject matter that the provider would not otherwise have rights to through its ownership or patent coverage of the material alone. Reach-through provisions are considered undesirable by many recipients because they burden all the developments created after the use of the material, and because they are seen as providing an unfairly high level of compensation to the provider for use of the material. It is more common to find MTAs used in applied research projects than in most other areas of research and development.

2.2 What is a CRADA?

A CRADA is a Cooperative Research and Development Agreement. It is a written agreement between a private company and a government agency to work together on a project. By entering into a CRADA, the Federal government and non-Federal partners can optimize their resources and economically perform research by sharing the costs of this research. The collaborating partner agrees to provide funds, personnel, services, facilities, equipment or other resources needed to conduct a specific research or development effort while the Federal government agrees to provide similar resources *but not funds* directly to the partner.

The CRADA vehicle provides incentives that can help speed the commercialization of federally developed technology, making it an excellent technology transfer tool. The Government protects any proprietary information brought to the CRADA effort by the partner. This provides a true collaborative opportunity. Federal scientists can work closely with their non-Federal counterparts, exchanging ideas and information while protecting company secrets. Also, all parties can mutually agree, if they so desire, to keep research results emerging from the CRADA confidential and free from disclosure through the Freedom of Information Act for up to 5 years. CRADAs also allow flexibility in patenting and patent licensing; enabling the government and the collaborating partner to share patents and patent licenses or permitting one partner may retain exclusive rights to a patent or patent license.

2.3 To Summarize, CRADAs offer the Following Benefits:

- Enable both partners to stretch their research budgets and optimize resources.
- Provide a means for sharing technical expertise, ideas, and information in a protected environment. The Federal government can protect from disclosure any proprietary information brought to the CRADA effort by the partner(s).
- Permit Federal and non-Federal scientists to work closely and offer non-Federal partners access to a wide range of expertise in many disciplines within the Federal government.
- Allow the partners to agree to share intellectual property emerging from the effort or to agree that one partner may retain exclusive license to patent research.

- Permit the Federal government to protect information emerging from the CRADA from disclosure for up to 5 years, if this is desirable.
- Most CRADAs are 100% industry-funded, although costs may be shared through contributions of personnel, equipment, services, or facilities.

2.4 When do I use an MTA or a CRADA?

An MTA generally is used when any proprietary material and/or information is exchanged, when the receiving party intends to use it for his/her own research purposes, and when no research collaboration between scientists is planned. Neither rights in intellectual property nor rights for commercial purposes may be granted under this type of agreement. MTAs define the terms and conditions under which the recipients of materials, provided by either the researcher or the other party, may use the materials. Included in the MTA are the requirements to use the materials for research purposes only.

CRADAs are used when a cooperative R&D project between the US Government and the private sector is contemplated. CRADAS allow for the exchange of material and/or research and development collaboration over a substantial period. CRADAs are also used when one or more parties supply staff or equipment; or when the industrial partner contributes funding or requests the granting of intellectual property rights. A CRADA may also be necessary in instances where a company is providing an otherwise non-available material and requests the transfer of intellectual property rights in the result of associated research.

3.0 SUCCESS STORIES

The following projects demonstrate for the reader some specific examples of how technology transfer has benefited both industry and the US Government.

3.1 A Billion-Dollar Library of Training Tools

The Army's Simulation, Training, and Instrumentation Command (STRICOM) helped form the Training and Simulation Technology Consortium (TSTC) of Orlando, FL. This project stemmed from the need to bridge the gap between those needing training expertise and the $1 billion-plus inventory of training solutions. The TSTC is a group of three DOD/NASA agencies, four defense contractors, and an educational institution. Each of these organizations is a recognized leader in the field of training and simulation technology.

The Army, along with the other TSTC founders, built an inventory of advanced training solutions valued at more than a billion dollars. These high-technology simulation and training solutions are in use around the world under the most challenging circumstances. TSTC provides an opportunity for private sector organizations to gain from government-funded training research and development. The Consortium, which received $2.4 million initial funding in May 1994 through the ARPA Technology Reinvestment Program, matched the grant and that resulted in a three year $4.8 million program. TSTC provides technology and expertise of its members to proposed target audiences. The following lists a few of the available capabilities in general terms.

3.2 Simulation

Using computers, video screens, and control panels to reproduce in sight and sound what likely will occur in actual performance, simulation is a training tool the Army and other Consortium members use to reduce the cost and danger of training personnel to operate sophisticated equipment in a realistic arena (actual conditions). Military and space projects have proven the merits of simulation as a training tool. Many accidents are avoided when an inexperienced operator is allowed to practice on a simulator before moving to the actual equipment.

For even the most experienced operators, simulation provides an opportunity to practice emergency maneuvers and other procedures that are too dangerous to perform in the field, or simply to hone their skills at little cost to the taxpayer.

Simulators have virtually no impact on the environment, and reduce the amount of fuel, ammunition, equipment wear and tear, and other resources consumed in field training. Many simulation systems in the Consortium's library have direct relevance to industrial and government needs, such as firearm and tactical training for law enforcement officers, driver training for commercial truck and bus operators, and flight training for commercial pilots.

3.3 Distributed Interactive Simulation

The DOD has expanded the use of simulation technology by tying together related simulation activities, allowing users to interact in a multidimensional setting. For example, Distributed Interactive Simulation can be used to allow a tank commander at Fort Knox in Kentucky to participate in a simulated field exercise with an F-14 pilot at the Naval Air Station in Pensacola, FL. Both participants can communicate and interact as if they were operating their respective equipment in the same area. This parallels industrial and government applications such as disaster planning, emergency response, and hostage situations, where multiple organizations at multiple locations must train together to function as an effective team.

3.4 Virtual Reality

Like simulation, virtual reality technology allows an operator to experience phenomena likely to occur in actual performance, bringing with it all the advantages of simulation. Unlike conventional simulation with mock-up control panels and two-dimensional images projected onto a screen or video monitor, virtual reality projects the operator into a three-dimensional simulation. Images are projected onto special goggles to create a three-dimensional effect. Other equipment is used to sense head, body, leg, arm, and hand motion, allowing the operator to move in virtual space and even touch virtual objects.

3.5 Computer-Based Training

The military pioneered the instructional design process and has set the standard for design and development of computer-based training, including the integration of computers, CD-ROM, audio,

touch-screens, video, and the like. The military's Defense Instructional Technology Information System (DITIS) lists over 3,000 interactive training courses already prepared.

Consortium members have developed several instructional design and development tools to help produce custom courseware for many of the tasks associated with training in today's fast-paced market. These off-the-shelf tools and relevant courses can increase the efficiency and return on investment of custom course development.

3.6 Electronic Performance Support

Whether on the battlefield or in a high-technology factory, the ability to quickly retrieve and understand information is critical to an operation's success. An Electronic Performance Support System (EPSS) uses interactive multimedia systems to provide technical workers with information, computer-based training, reference databases, and on-line help/advice. Using a multimedia approach, the system can communicate information through text, pictures, sounds, and video clips, directly to the shop floor. Through the use of EPSS, the military has experienced substantial decreases in training time, cost, and paper documentation while increasing employee retention and productivity.

3.7 Decision Support

Consortium members have developed tools to help managers plan for and execute change within their companies. Time-proven analysis techniques have been developed for estimating personnel and training requirements for new or modified operational systems or production facilities. These decision-support tools provide methods to estimate life cycle costs, labor requirements, inventory levels, and schedule implementation rates. They also can be used to identify required personnel aptitudes and characteristics for the new systems or procedures. These tools are invaluable for rapid and successful expansion planning, new technology implementation, and manufacturing process development.

3.8 Improving Helicopters

Helicopters are playing a more important role in solving commuter transportation problems. Already, over 6,000 civilian helicopters operate in the United States-and this number is growing quickly. The Army, with its vast experience in helicopter design and operation, is helping commercial firms create the next generation of helicopters that can fly more safely, faster, and on less fuel. Following are two examples of how the Army is helping commercial firms design better helicopters.

3.9 New Analysis Tool

The Aeroflightdynamics Directorate of the Army Aviation and Troop Command (ATCOM) has developed and transferred a new comprehensive computer software system to the U.S. helicopter industry to help design both military and civilian rotorcraft. The sophisticated program's rotorcraft analysis capabilities go far beyond those available with previous systems, including rotor configuration (articulated, tandem, tilt rotor, etc.), fuselage shape, auxiliary lifting surfaces, automatic flight control, propulsion and drive systems, and aerodynamic effects. Designed for ease of use, the program has a fully interactive, menu-driven user interface.

A multidisciplinary and multi-organizational approach resulted in a superior analysis tool for all stages of rotorcraft development from basic R&D to design, testing, and performance evaluation of the finished product. Development team members include helicopter manufacturers Sikorsky Aircraft Co., McDonnell Douglas Helicopter Corp., Boeing Helicopter Co., and Kaman Aerospace Corporation; R&D firms United Technologies Research Center, Computer Sciences Corp., Sterling Federal Systems, and Advanced Rotorcraft Technology, Inc.; and universities University of Maryland, Georgia Tech Research Institute, and Rensselaer Polytechnic Institute.

The Army released the first version (V 2.3) for commercial use in March 1994. The software has been distributed to over 15 industry, government, and university sites in the United States. The Aeroflightdynamics Directorate has held training classes to provide a hands-on transfer of this Army technology to both government and private sector users. In addition, the Directorate provides continuing user support to maintain, enhance, and validate the program.

3.10 Rotor Blade Load Prediction

The Army Research Laboratory (ARL) Vehicle Structures Directorate entered into two Cooperative Research and Development Agreements (CRADA) to enhance a software tool for predicting the loads or forces on a helicopter rotor blade during flight. Although this analysis is limited to just one part of the helicopter (the rotor blade), it represents a tremendously complex engineering problem. Unlike fixed-wing aircraft, helicopters receive lift, direction, and speed from long, slender blades that flex, bend, twist, and vibrate while rotating at high speeds. The Army is helping commercial firms improve their ability to predict rotor blade behavior.

The goal of one CRDA, with Advanced Technologies, Inc. (ATI), is to enhance the University of Maryland's Advanced Rotor Code (UMARC). The data from this engineering software package provides a detailed, visually represented span wise load distribution. This CRADA brings together two former colleagues with key experience: Dr. Mark Nixon of ARL and Dr. Naipei Bi of ATI. Both were instrumental in the original development of the UMARC program while working on their Ph.D.s at the University of Maryland. Thanks to the CRADA technology-transfer mechanism, they could collaborate once again to improve the UMARC program.

Using pictures of predicted loads on a rotor blade that show how the loads vary along the length of the blade, engineers design blades that will safely lift more with less fuel use. ATI is now using this Army technology to improve the design of the commercial S-61 helicopter. In addition to helping ATI solve this problem, the UMARC enhancement will also give the Army more data to better understand the forces exerted on rotor blades used in military aircraft.

The other CRDA, with Sikorsky Aircraft, enhanced the Sikorsky version of the UMARC code to include a bearingless-gimbal rotor configuration and new trim options for tilt rotors. These features allow Sikorsky to perform analysis in support of its Variable Diameter Tilt rotor (VDTR) concept, and will bring new, improved analysis tools to the Army as well.

Sharing Army technology with commercial firms may make rotorcraft commuting a viable option for the civilian worker of the future.

3.11 Reconfigurable Asymmetrical ISR Development (Raid)

Intelligence, Surveillance, and Reconnaissance (ISR).

The RAID simulation simulates the sensor system, target object models, and the intelligence cycle. The purpose of RAID is to provide users with a tool that will provide credible data for use in Advanced Concepts Research (ACR). This is a cooperative program between the Battle Command Battle Lab (BCBL) at the US Army Intelligence Center, Ft. Huachuca, AZ and an industry leader in simulation design, Veridian Information Solutions (VIS). In this cooperative effort, the BCBL provides facilities, projects, and subject matter expertise that will improve Raid's functionality. VIS provides all software engineering, project management, and allows BCBL unrestricted local use of the RAID software.

The RAID sensor system models are wholly re-used software objects originally developed for the Joint Tactical Intelligence Model (JTIM), formerly known as the WARSIM Intelligence Module (WIM) federate of the Joint Simulation System (JSIMS). The RAID combat models provide HLA Federate Objects (FO) and Interaction data consistent with the JSIMS Federate Object Model (FOM).

RAID builds on JSIMS Common Components (SNE, CCSE, HLA-RTI, SCC, et al.) and intelligence models initially developed for JSIMS training application JTIM. RAID will provide the user an ability to configure the simulated battlespace with sensor systems and target models of both OPFOR and BLUFOR. The modeling technique allows sensor and target models to be re-parameterized to support new or proposed systems and architectures.

RAID is a comprehensive simulation that meets Service and Joint ACR modeling requirements, spanning tactical to strategic-national echelons. RAID creates a simulation environment that stress intelligence assets and provide data that quantifies the effectiveness of intelligence systems and architectures. RAID will evolve fully to support the conclusion phase of the ACR process.

RAID sensor system models simulate the six phases of the intelligence cycle (Planning and Direction; Collection; Processing and Exploitation; Production: Dissemination and Integration; Evaluation) for purposes of assessing multi-service intelligence architectures. RAID re-uses JTIM and select JSIMS common components to simulate intelligence assets and behaviors, interface to Command, Control, Communications, Computers and Intelligence (C4I) systems, support intelligence analysts through user interfaces, and After Action Review (AAR) analysis.

RAID sensor system models represent Signals Intelligence (SIGINT), Imagery Intelligence (IMINT), Measurement and Signature Intelligence (MASINT), and Human Intelligence (HUMINT) collection systems, that includes tasking and the products these intelligence disciplines produce. Intelligence

products from RAID sensors will exist at varying levels of detail (raw data, initial interpretation, correlated, and fused) depending on the analysis objectives and focus of the user-designed architecture.

Practical use of RAID will assist developers in providing definitive data to support:

- The design of future intelligence architectures
- The value of various collection assets
- Evaluate various intelligence processes
- Optimize intelligence collection for contingency operations
- Optimize intelligence collection for current operations
- Assist Commanders and Staffs in designing force protection packages
- Enterprise level simulation exercises

4.0 CONCLUSION

This paper has provided the reader with a broad explanation of how the US Government and Industry shares resources to the benefit of the collaborators and other interested parties. The support of this goal came from providing the basis in law the supports cooperative research, the various methods of regulation of cooperation, and examples of cooperative programs. The author's intent is to provide a working model that other nations may wish to use as a basis of cooperative research to meet their own requirements.

5.0 ADDITIONAL RESOURCES:

The following Internet web sites provide additional information of the various programs highlighted in the paper. The web sites also include generic agreement forms for review. The reader should note that there are no standard requirements for these agreements.

http://www.arl.army.mil

http://www.crrel.usace.army.mil/partnering/partnering.html

http://ott.od.nih.gov

http://www.usgs.gov/tech-transfer/what-crada.html

http://www.dtic.mil/techtransit/

RTA/MSG Conference on NATO/PfP/industry/national Modeling and Simulation Partnerships

Essential in Peace, Indispensable in War

Partnerships That Work

Dr. Gary W. Allen
US Army Liaison Officer to BWB (Germany)

A Review of Government-industry Cooperative Research Agreements

Agenda

- Overview
- Legal background
- Types of agreements
- Approval process
- RAID – a success story
- Conclusion

Legal Background

- Stevenson-Wydler act 1980
- Federal tech transfer act 1986
- Executive order 12591
- National technology transfer & advancement act 1995

Bottom line

Make cooperation easier & profitable

Types of Agreements

- Technology transfer v. Cooperative developments
- Material transfer agreement (MTA)
- Cooperative research and development agreements (CRADA)
- When to use which?

The Process

Identify Requirement

Establish the terms of cooperation

Legal Review

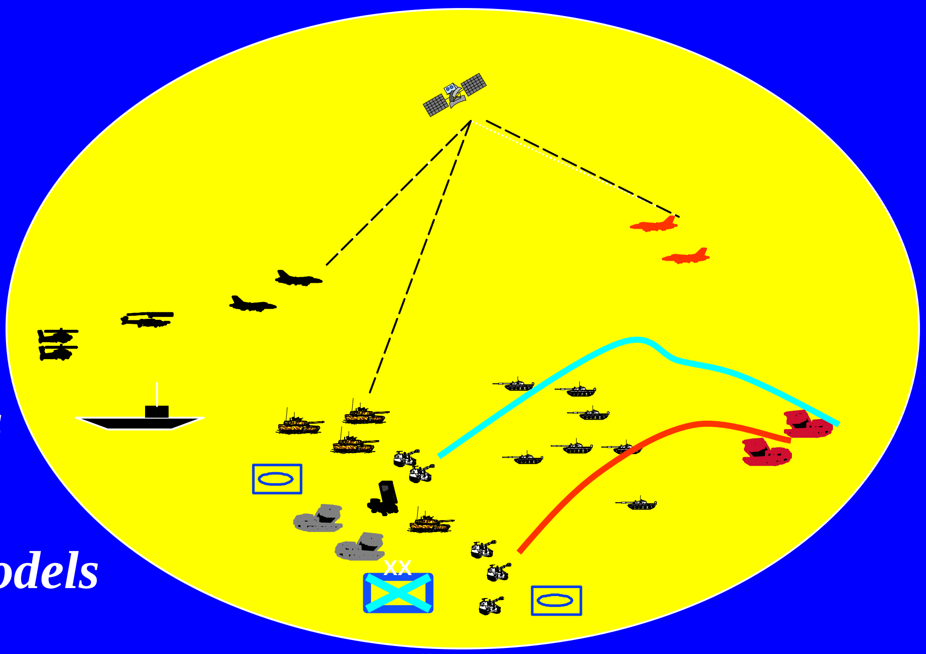
Approval Process

Implement & Deliver

What Do These Items Have In Common?

RAID – a Success Story

Reconfigurable Asymmetric ISR Development



War, Major Regional Conflicts, and Small Scale Contingencies

- *C2 Structure*
- *Maritime Models*
- *Land Combat Models*
- *Air and Space Models*
- *Synthetic Natural Environment*

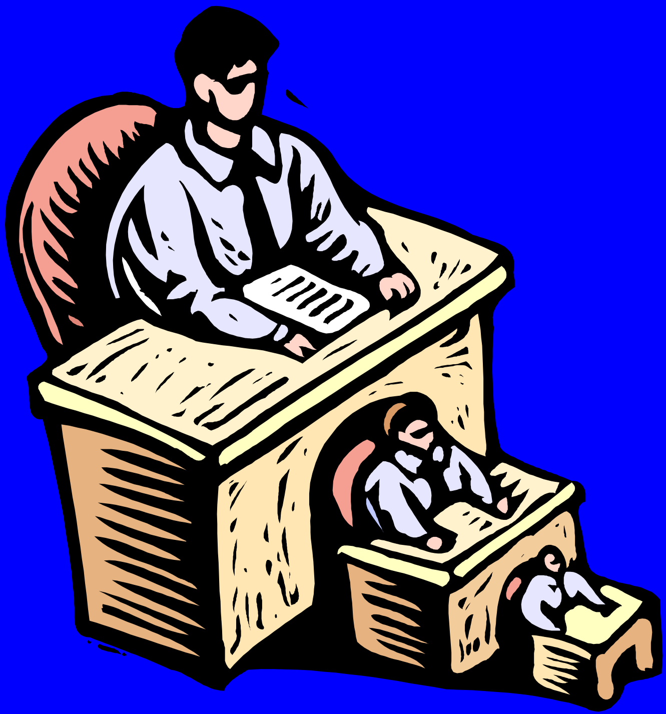
Data-driven lightweight combat models for use as ISR targets and intelligence host units. Very limited combat behaviors.

Project Resources (Government)

- US Army
  - SME Review
  - Test Bed
  - Hardware/Software
  - Work Space

Project Resources (Industry)

- Veridian Information Solutions
  - Program management
  - Software development
  - System integration
  - Training
  - Documentation



Benefits from cooperation

- For Government
  - Fills unfunded requirement
  - Quick response to needs
  - Influence the market
- For Industry
  - Validate market need
  - Real world test bed
  - SME design input

Conclusion

- Model of government/industry cooperation
- This is a common practice
- Mutually beneficial program
- Additional Information
  - www.crrel.usace.army.mil/partnering
  - www.usgs.gov/tech-transfer/what-crada.html
  - www.dtic.mil/techtransit
  - gary.allen@us.army.mil